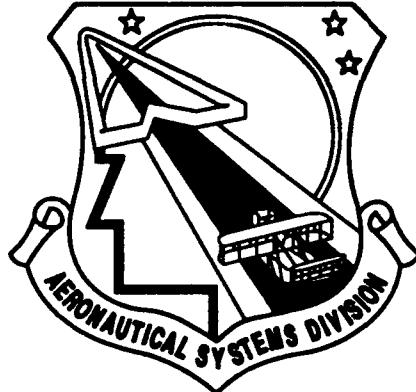


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**A DETERMINATION OF MILITARY AND CIVILIAN
PERSONNEL COSTS AS RELATED TO A
MEMBER OF TECHNICAL STAFF**

Joseph L. Weingarten
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Wright-Patterson AFB, Ohio 45433-6503

June 1992

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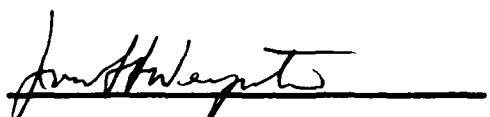
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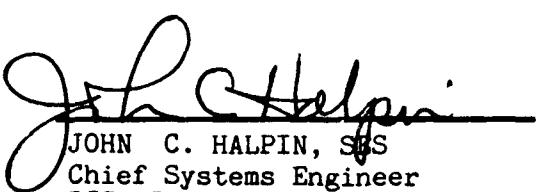
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13. ABSTRACT (Maximum 200 words) This report provides a total cost analysis of the organic work force within the Aeronautical Systems Division's, DCS for Integrated Engineering and Technical Management. This study details all costs relative to obtain a total cost, including all overhead functions, to the government of these engineers and the relationship of that cost to Federally Funded Research and Development Center personnel. The costs are base lined to a common cost factor of the Member of Technical Staff, which is the cost of one year of technical support to an effort.			
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1. Summary

In the new Air Force Materiel Command (AFMC) we will find four types of engineering work forces, two of these are organic to the government and the other two are contracted. The organic work force consists of government employees who work in either an acquisition or in a service engineering environment. The contractors can be viewed as either a short term contractor, SETA (Scientific, Engineering, and Technical Assistance) or a long term effort, FFRDC (Federally Funded Research and Development Center). The FFRDC is where a long term relationship exists between the government and the contractor. A FFRDC is a private, public-service organization as a non-for-profit entity. They are established at the government's request to perform, analyze, integrate, support and/or manage basic or applied research and/or development in support of a long range need such as systems engineering. A primary difference between a government and FFRDC engineer is that the government engineer can develop policy, whereas the FFRDC organization can only accomplish engineering tasks. Within AFMC five FFRDC's exist; there are two primary contractors located at Electronic Systems Division, Mitre Corporation and at Space Systems Division, Aerospace Corporation. A SETA contractor is more of a specialized short-term effort. The costs of a SETA contractor are project dependent, based on hours of service. Over the years there has been an inability to compare the costs of the organic work force with that of the contractors. The usual Apple to Orange argument has developed each time. The government bases its employee costs only on payroll and benefits, whereas industry includes all overhead factors. The object of this study was to develop a cost factor for a government engineer that would allow a closer comparison between the organic development of an FFRDC and SETA engineer.

2. Member of Technical Staff

This study was accomplished to determine an actual cost to the government of an acquisition engineer at the Aeronautical Systems Division.

Who is a Member of Technical Staff (MTS)? This is an engineer and his/her work effort in a technical subject area within the organization mission and all the elements needed to support that engineer. By this we include typing by a secretary, to include both the payroll and benefits of that secretary for whatever time she/he is supporting the engineer, management directing the engineer, pencil and paper, and even such things as the time of a personnel clerk, in another organization who processes records on the engineer. Therefore, an MTS can also be considered a "manyear of technical service" and is not limited to the payroll and benefits of any one individual, but may be made up of many individuals who are supporting that person.

A basic problem within government is the assessment of what is the true cost of an employee relative to industry. In asking this question of government it seems that it is extremely hard to obtain a realistic number or even an approach. Many times the answer is the actual payroll with a percent factor for benefits. Yet within industry, it appears the actual cost is very attainable and can be very precise.

Within government we did not need to compute overall costs and overhead values as we require our contractors to determine a percent of profit. A few studies and audits have been accomplished over the years but none that were comprehensive across all of the product divisions. Most would just view one product division or one segment of that division. This study falls into the same category as it just views the ASD acquisition engineer.

Thus past efforts within the Air Force have only viewed the more direct costs, such as salary, insurance, retirement, and have ignored the costs of doing business or supporting the upkeep of personnel. In this report we will be reviewing as many of the cost factors as possible to determine the full expense to maintain a person. This consolidated cost no longer becomes a personnel cost but rather a cost of a work year of effort. In this case we will provide the cost of a technical work year at ASD. This would be the support to ASD of one engineer at a certain skill level for an entire year. For example, if five engineers are supported by one secretary, then

one-fifth of the secretary's salary, benefits, and even the cost of supplies used by that secretary would be added to the direct salary cost of the engineer. In this study the cost of a secretary, for example, was applied across all of the professional work force. In some work areas there may be a ratio of 1:1 of secretaries to professionals while in others the ratio may be 1:25 or even 1:40. The application of all secretaries to all professional employees allows for a better understanding of the costs of the entire organization.

In the development of the MTS the costs are broken into two basic areas. The first is the direct cost such as salary and benefits that form the basis of traditional cost estimates. The second area is more complex and this is where an effort will be made to provide the support costs, such as secretaries, supplies, and support personnel. This is the complex area. The cost of facilities, both in government and in the Federal Funded Research and Development Centers such as Mitre and Aerospace Corporation, is another complex area that is covered within this report. This will allow the development of corresponding dollar factors between an organic and FFRDC engineer. The factors and resultant costs within the framework of this study are not exact, but rather an estimate and an approach on how to determine these costs. To obtain an exact cost addition work would have to be accomplished to obtain the fidelity required. It is believed that the methods and metrics used do provide a realistic value can be used for basic comparisons.

3. Primary Costs

In 1988 the Rand Corporation published a report "Incremental Costs of Military and Civilian Manpower in the Military Services." This document provides the basis for this section. The report assesses comparative costs of both active military personnel and civil service employees. The factors include direct payroll, indirect labor costs such as medical care expenses, and those costs relative to movement, whether in or out of the service or between assignments. The study did not take into account special pay rates which are provided to entering and lower grade engineers. These factors were added to reflect the total salary and fringe benefits for the ASD engineers. Table 1 provides the salary and fringe benefits as reflected in

Table 1. Direct Total Manpower Budget Costs 1986

INCLUDES ALL SALARY AND FRINGE BENEFITS

Military Rank	Cost(\$)	Civilian Engineer	Cost(\$)	Civilian	Cost(\$)
O-10	118,701.00				
O-9	117,001.00				
O-8	116,501.00				
O-7	104,756.00	SES (ES-4)	80,743.00	SES (ES-4)	80,743.00
O-6	87,817.00	GM-15	74,213.00	GM-15	74,213.00
		GS-15	74,378.00	GS-15	74,378.00
O-5	74,131.00	GM-14	62,559.00	GM-14	62,559.00
		GS-14	64,006.00	GS-14	64,006.00
O-4	62,774.00	GM-13	52,633.00	GM-13	52,633.00
		GS-13	53,865.00	GS-13	53,865.00
O-3	51,624.00	GS-12	46,695.00	GS-12	44,088.00
O-2	40,225.00	GS-11	39,079.00	GS-11	36,811.00
		GS-09	37,400.00	GS-09	31,108.00
O-1	30,335.00	GS-07	30,915.00	GS-07	25,775.00
		GS-05	25,268.00	GS-06	23,800.00
DATA IS BASED ON "INCREMENTAL COSTS OF MILITARY AND CIVILIAN MANPOWER IN THE MILITARY SERVICES", THE RAND CORPORATION, JULY 1988.					
				GS-05	21,118.00
				GS-04	18,651.00
				GS-03	16,441.00
				GS-02	14,520.00

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the report for 1986. Table 2 is an estimate of 1992 salary and fringe benefits for these employees. The salary and fringe benefits in Table 2 is computed from the Table 1 data and is based on each year pay increases as shown in Table 3. These increases were the same for both civilian and military and are based on an average pay increase. Further, it was assumed that the percent increase of pay would be reflected in any increases in benefits. This may actually result in a higher ratio as the amount and value of benefits have been reduced over the past few years with exception of the new retirement system that increases the cost to the government.

Table 2. Direct Total Manpower Budget Costs 1992
INCLUDES ALL SALARY AND FRINGE BENEFITS

Military Rank	Cost(\$)	Civilian Engineer	Cost(\$)	Civilian	Cost(\$)
O-10	148,000.00				
O-9	143,911.00				
O-8	143,296.00				
O-7	128,849.00	SES (ES-4)	122,720.00	SES (ES-4)	122,720.00
O-6	108,015.00	GM-15	91,281.00	GM-15	91,281.00
		GS-15	91,485.00	GS-15	91,485.00
O-5	91,181.00	GM-14	76,974.00	GM-14	76,974.00
		GS-14	78,727.00	GS-14	78,727.00
O-4	77,212.00	GM-13	64,738.00	GM-13	64,738.00
		GS-13	66,253.00	GS-13	66,253.00
O-3	63,497.00	GS-12	57,434.00	GS-12	54,228.00
O-2	49,476.00	GS-11	48,067.00	GS-11	45,277.00
		GS-09	46,002.00	GS-09	38,262.00
O-1	37,312.00	GS-07	38,025.00	GS-07	31,703.00
		GS-05	31,079.00	GS-06	29,274.00
				GS-05	25,975.00
				GS-04	22,940.00
				GS-03	20,222.00
				GS-02	17,860.00
DATA IS BASED ON "INCREMENTAL COSTS OF MILITARY AND CIVILIAN MANPOWER IN THE MILITARY SERVICES", THE RAND CORPORATION, JULY 1982. THE BASE DATA REFLECTS 1986 PAYROL AND HAS BEEN INCREASED TO 1992 PAY SCALES BASED ON ANNUAL PERCENT PAY RAISES AND SPECIAL PAY RATES FOR SCIENTIFIC AND TECHNICAL PERSONNEL.					

4/17/92 ASD/ENO

While the Rand study is 6 years old, and the pay increases are applied as a direct ratio, it is within estimated parameters for the total salary and fringe benefits. For example, GS/GM-13 average costs is approximately \$65,500. In the past ASD/FM used a factor of 18.1% to compute cost of benefits associated with government employment they currently use 17.1%, to be conservative the higher factor was used. Using this factor the cost of a GS-13 step 5 is approximately \$62,000. The Rand study includes indirect factors such as the cost of moving from one station to another and some Morale, Welfare and Recreation costs that are not included in the benefit factor. These indirect costs can account for the slightly higher factor that was developed using the Rand study as a base line. It also shows that these computed costs are more realistic than the traditional factors. Another correlation that was viewed was that of a new program called Civilian Resource Management System (CHARMS). This program establishes cost factors for federal employees. A GS-13 step 5 is computed two ways based on either of the two retirement systems. Using the Civil Service Retirement System the pay is factored at \$61,400 and with the Federal Employees Retirement System the pay is \$69,970 per year. The Rand study did not view the different retirement systems but rather included both in factoring a value. If we average the two CHARMS values, the number is \$65,685.00. Based on the close correlation it was determined that the modified Rand data would be used within this study. In addition this shows that with time, as personnel retire and the number of employees in the new system increase, the overall cost to the government will increase.

Table 3.
Pay Raises 1985-1992

Effective Date	Average Increase
1 Jan 85	3.50
1 Jan 87	3.00
1 Jan 88	2.00
1 Jan 89	4.10
1 Jan 90	3.60
1 Jan 91	4.10
1 Jan 92	4.20

4. Supporting Elements

For every person in any type of work, other people provide support and other elements of support are provided. Within this context we can view the support in three categories. The first is equipment, supplies and training and other similar items provided to the engineer to accomplish his/her job. The second is the most complex to determine and is the support of other elements within the overall organization. This includes the personnel office, graphics, and such personnel as the movers. The third will be support internal to the organization, such as secretaries, clerical and management. This also required addition of the first two factors for these employees, thus an administrative clerk must also be included in their cost factor the cost of equipment, support, etc. With all three factors the total cost per technical employee can be added to the direct budget cost for a total MTS cost.

1. Equipment and supplies:

A. Supplies - At ASD every person is allocated \$100.00 towards paper, pencils and general supplies.

Source ASD/FM

B. Technical Equipment - The cost of technical equipment was based on a computer with a life of 5 years that, including software, has an initial cost of \$3,000.00. In November 1991 it was found that the ratio of computers to personnel was 0.78; therefore, each person could be allocated \$470.00 per year for a computer. The organization target is to move from 0.78 to 0.90 ratio which would increase the allocation per person to \$540.00 per year. The cost of maintaining that system is \$312.00 per year per machine, therefore, the cost per employee is \$281.00. Another computer cost is the procurement and maintenance of several larger general purpose mainframes such as VAX computers. This is valued at \$332.00 per employee. Over the last several years the amount of other equipment funds has been minimal to a maximum of approximately \$100.00 per person. For purposes of this study the high values were selected in each case. This would allow for growth to the higher value and is believed to be a more realistic value as constraints that the government operates under would be removed. The common use technical computers would not be allocated as a cost to the non technical work force.

Technical

Computer	540.00
Computer Maintenance	281.00
Common Use Computers	332.00
Common Use Equipment	100.00
Total	\$ 1253.00

Non Technical

Computer	540.00
Computer Maintenance	281.00
Common Use Equipment	100.00
Total	\$921.00

Source ASD/ENO

C. Communications - The total cost of communications for ASD for FY 92 is projected at \$4.448M. This is based on a population of 11,120 personnel, thus the cost per person is \$400.00 per year. FY 91 costs were unavailable.

Source DMATS

D. Copiers - In FY 91 the cost of copying at ASD was \$1.491M and this included ASD, Wright Laboratory and the 4950th Test Wing. It was assumed that this value would be approximately the same for FY 92. The assigned population at that time for those organizations was 11,120 thus the cost per person was \$134.00.

Source ASD/RM

E. Training - Training is applied in two categories: technical and administrative. It is recognized that the technical training costs are higher on a per capita basis than the type of courses offered to the secretaries and clerical employees. Approximately 95% of the total costs are for technical (includes S&E and Manufacturing) training and the remaining administrative. The total expenditure for FY 91 was \$608,227 in the system program offices and \$247,500 in the home office. Based on 1 Oct 91 personnel level, the training costs per person are:

S&E	\$495.00
Administrative	\$231.00

Source ASD/ENO

F. Travel - Travel is computed only on home office person-

nel. All employees in the SPO when traveling would be in direct support of a program and this would be considered direct program costs. The travel budget for FY 92 is \$289,000.00. Approximately 95% of travel is in support of the engineering function and this value was applied to the engineering and high level personnel work force with the remainder to the administrative.

S&E, Management	\$545.00
Administrative	\$118.00

Source ASD/ENO

Totals - These are provided as average values for both professional (including S&E and Manufacturing) and administrative that includes secretaries, clerical and administrative personnel and are shown in Table 4.

Table 4

Support Costs

Item	Professional	Administrative
Supplies	100.00	100.00
Technical Equipment	1253.00	921.00
Communications	400.00	400.00
Copies	134.00	134.00
Training	495.00	231.00
Travel	545.00	118.00
Total	2927.00	1904.00

2. Personnel Support Costs Internal

Support cost can be viewed in two separate ways: internal and external to the reporting organization. Within this effort the supporting personnel were viewed internal to engineering first and then to other ASD organizations.

A. Internal - It was assumed that the following personnel are included in computation of the cost factors to be applied to the engineering work force: Secretaries, clerical, administrative and 50% of branch, division and other management personnel time. Why 50%? Within the

engineering organization this was an approximate time for these personnel working technical efforts in support of the ASD mission. Other internal support groups are included in this total, such as the Specifications and Standards Division and the other laboratory type activities. In the case of the Manufacturing Directorate, professional personnel were counted as S&E's, as were technicians working in an S&E position, even if they did not have an engineering skill code.

Table 5 Internal Support Personnel

Secretary, Clerical	Number
GS-07	2
GS-06	59
GS-05	87
GS-04	2
GS-03	1
Administrative	
GS-07	15
GS-06	5
GS-05	11
SGT	1
Management	
Col	1
GM-15	22
Lt Col	3
GM-14	52
GM-13	1
Support Technicians	
GS-12	6
GS-11	5
GS-09	7
GS-07	1
GS-06	5
GS-05	1

B. External - The following lists all ASD support organizations and the projected role in supporting the engineering work force. These factors will then be added to the overall costs of both the internal support and the engineering support to determine a final value. From an overall perspective, the engineering organization (ASD/EN) represents 18% of the total ASD

work force. The actual engineers account for approximately 14.5% of ASD. In the following only those organizations that support engineering are listed. Instead of attempting to determine each person within those organizations, a salary base was computed and increased by 20% for benefits and some overhead to compute the final values of dollar support. The value provided is based on the total payroll cost to the organization listed per year, divided by the authorizations and multiplied by the allocation factor to obtain an average cost per person to provide support. The total cost to the engineering community is then computed based on the number of people from that organization who provide support. As stated above, civil engineering and housing costs are not included.

(1.) ASD/CC/CS - This is the ASD Command Section consisting of 109 authorizations. Since this office functions in a leadership role across all of ASD, a full 18% of the total costs will be included in the final factor: 18% allocation is \$ 512,347.00

(2.) ASD/DP - The personnel unit at ASD not only services ASD but also other organizations at Wright-Patterson AFB. Thus, the factor is reduced to 15% with a budget of \$1,322,047.00

(3.) ASD/FM - The financial organization has a primary functional mission to support the system program offices just as does the engineering community. One of its other functions is to support travel in processing of TDY and payments, other internal functions also exist such as budget development that are related to the individual worker. The support in this area is being applied only to the engineering work force and not to the administrative. Almost all travel and most budget activities relate to the engineers and not to the rest of the organization. Also in comparison, the amount of travel in the home office is low compared to the program office travel. The cost of this support is \$553,439.00 and is computed at a 5% level.

(4.) ASD/PA - The primary focus of the public affairs office is towards information concerning the programs. They also provide support to the engineering community such as press releases, home town news and security review for papers to be published. It was estimated by ASD/PA that 5% of their time was in support of ASD/EN. Thus, the cost is \$40,968.00.

(5.) ASD/RM - Provides overall support to all ASD functions in a number of areas. This includes supplies, audiovisual, movers, copy and printing support, documentation, etc. It is my belief that this group could be allocated on an overall basis of 18% of the total of 191 personnel with a cost factor of \$1,312,429.00,

(6.) ASD/SE - The safety office provides ground safety support to a very small extent within the overall context of the organization and the allocation was determined to be one person. The cost per year is \$46,609.00.

(7.) ASD/SP - Within the security police area, we receive support for clearing/checking of vaults, educational support for our personnel and operational security. The support is approximately one work year. The cost is \$ 44,438.00.

(8.) METB - The METB Team supports tracking of manpower authorizations for the DCS and this support was computed at one-half each of GS-12 and GS-13. The cost is \$ 59,483.00.

The summary of the support costs are shown below in Table 6.

Table 6
External Personnel Support Costs

The total external cost is:

ASD/CC/CS	\$ 512,347.00
ASD/DP	1,322,047.00
ASD/FM	553,439.00
ASD/PA	40,968.00
ASD/RM	1,312,429.00
ASD/SE	46,609.00
ASD/SP	44,438.00
METB	59,483.00
 Total Costs	 \$ 3,889,176.00

This cost as applied to 1827 personnel results in a cost per person of \$2,130.00

The total external costs were factored into the cost per person to develop a cost per person within the DCS. This was first applied as shown in Table 7, to compute a support personnel cost including both the internal and external support factors to provide a total cost at the grades of the supporting personnel. This cost total was then applied as shown in Table 8

Table 7
ASD/EN Personnel Support Costs

Type	Grade	Raw Cost	Eq/Sup Costs	External SUP	Total
Sec/Clerical	GS-07	31,703.	1904.	2130.	35,737.
	GS-06	29,274.	1904.	2130.	33,308.
	GS-05	25,975.	1904.	2130.	30,009.
	GS-04	22,940.	1904.	2130.	26,974.
	GS-03	20,222.	1904.	2130.	24,258.
ADMIN	GS-07	31,703.	1904	2130.	35,737.
	GS-06	29,274.	1904.	2130.	33,308.
	GS-05	25,975.	1904.	2130.	30,009.
MANAGEMENT	O-6	108,015.	2927.	2130.	113,072.
	GM-15	91,281.	2927.	2130.	96,338.
	LT COL	91,181	2927.	2130.	96,238.
	GM-14	76,974.	2927.	2130.	82,031.
	GM-13	64,738.	2927.	2130.	69,795.
SUP TECH	GS-12	54,228.	2927.	2130.	59,285.
	GS-11	45,277.	2927.	2130.	50,334.
	GS-09	38,262.	2927.	2130.	43,319.
	GS-07	31,703.	2927.	2130.	36,760
	GS-06	29,274.	2927.	2130.	34,331.
	GS-05	25,975.	2927.	2130.	31,032.

to provide a total cost to the DCS of personnel in a support function. The total cost is \$10,401,608.00. It should be noted that all management is factored at a 50% level of work effort for management and the other time is counted toward technical work efforts. This in part is due to reductions in personnel over the past 3 years. The pressure of these reductions can also be

found in other areas; for example, the number of clerical personnel is currently 50% lower than 3 years ago.

Table 8
Internal Support Costs

Position	Grade	Quantity	Factor (%)	Cost	Total
Sec/Clerical	GS-07	2	100	35,737	71,474
	GS-06	59	100	33,308	1,965,172
	GS-05	87	100	30,009	2,610,783
	GS-04	2	100	28,974	53,948
	GS-03	1	100	24,256	24,256
ADMIN	GS-07	15	100	35,737	536,055
	GS-06	5	100	33,308	166,540
	GS-05/SGT	12	100	30,009	360,108
MANAGEMENT	O-6	1	50	113,072	56,536
	GM-15	22	50	96,338	1,059,718
	O-5	3	50	96,238	144,357
	GM-14	52	50	82,031	2,132,806
	GM-13	1	100	69,795	69,795
SUPPORT TECH	GS-12	6	100	59,285	355,710
	GS-11	5	100	50,334	251,670
	GS-09	7	100	43,319	303,233
	GS-07	1	100	36,760	36,760
	GS-06	5	100	34,331	171,655
	GS-05	1	100	31,032	31,032
TOTAL					10,401,608.

The final cost factor will be the salary factor plus the support cost equalized per engineer/professional. To be conservative only the working technical personnel were used; the total engineers were not used to determine the overall support factor, but rather the total less those identified in the support category. This resulted in the level of engineers being 1,642 less those cited as management, at a 50% level, and less the 25 support technicians for a total of 1,578 personnel or an internal support cost per engineer of \$6,592.

The overall raw cost factor becomes:

**Total Raw Cost = (Salary + Benefits) + Equipment/Supply Support
+ External Support + Internal Support**

For example an average GS-14 would have the following total raw cost to the Air Force:

Salary + Benefits	\$	78,727.00
Eq/Supply		2,927.00
External Person Sup		2,130.00
Internal Personnel Sup		6,592.00
Total Raw Cost		\$ 90,376.00

For a GS-13 the total raw cost would be \$77,902.00

To the above various factors need to be added such as the facilities, insurance which are discussed in the next section to obtain the final total cost.

5.

Man-year of Technical Service

The actual cost of the man-year of technical service would be the total cost to ASD averaged to one engineer (MTS). Table 9 represents the number of professionals within the DCS. These numbers have been reduced by the personnel listed in section 3 to compute the support cost factor. The total number per grade will be used to compute the overall cost and then averaged to determine the non supported MTS cost. The salary and benefits from the 1992 Directed Table were used for the base line to compute payroll/benefits cost factor and to determine the final average amount of \$11,649.00. This amount is then added for the final MTS cost. The raw total cost as shown below in Table 9 is \$102,141,002.00 for an average of \$64,810.00 which results in a basic total cost of \$76,459. 00 per engineer/professional in ASD/EN.

Table 9
S&E Costs
(\\$)

Grade	Quantity	Less Mgt/Tech	Total MY	1992 Pay/Ben	Total
O-6	3	.5	2.5	108,015.	270,038.
O-5	28	1.5	26.5	91,181.	2,416,297.
O-4	52	0	52	77,212.	4,015,024.
O-3	237	0	237	63,497.	15,048,789.
O-2	37	0	37	49,476.	1,830,612.
O-1	22	0	22	37,312.	820,884.
SES	9	0	9	122,720.	1,104,480.
GM-15	79	11	68	91,281.	6,207,108.
GM-14	157	26	131	76,974.	10,083,594.
GS-14	27	0	27	78,727.	2,125,629.
GM-13	54	1	53	64,738.	3,431,114.
GS-13	372	0	372	66,253.	24,646,116.
GS-12	464	7	457	57,434.	26,247,338.
GS-11	64	5	59	48,067.	2,835,953.
GS-09	31	8	23	46,002.	1,058,046.
Total	1636	60	1576		102,141,002.00

Cost per Engineer ASD/EN \$64,810 +11,649 = \$76459.

* ENLISTED PERSONNEL ADDED WITH GS RANKS

The cost as listed above of \$76,459.00 per engineer/professional in ASD/EN is a basic number. There are several other factors that need to be applied to finalize this value. These factors are listed below and can be applied in varying amounts. Some of these factors allow for a better comparison with private sector costs.

1. Insurance- The government is self-insured while the private sector is not. In recognition of this factor the government has developed a cost factor relative to casualty and liability insurance.

A. Casualty insurance is computed based on the value of supplies and equipment. The value of supplies per year is \$100.00 assumed to be at a level of 50% over the entire year. Therefore, the value is \$50.00 for the purpose of this study. The equipment is not as easy. In the private sector equipment is depreciated based on its useful life and Internal Revenue Service guidelines. The values that were generated for table 4 for computer equipment are based on a life of 5 years per worker and are used here. The common use equipment value is based on a continuous replacement value and therefore is assumed to be used at that level for this study as a depreciated value. One value that has been left out in this study has been the cost of furniture. Within ASD most furniture has had a long life and in most cases was purchased with program funds. If we were to apply this cost to the individual, the life is 10 years with a cost of \$2000.00 per work station. The value per professional then becomes:

(Supplies/2) + Individual Computer + Common use Computer
+Common use Equipment + Furniture = Casualty Insurance Value

$$50+540+332+100+200= \$1222.00$$

The casualty insurance cost is determined by multiplying the above amount by the insurance factor defined in AFR 26-1, Chapter 9, Table VIII, which is 0.0005. The cost would be $\$1222.00 \times 0.0005 = \0.61

B. Liability insurance is also computed based on a factor provided from the same table in AFR 26-1 and is the personnel cost multiplied by 0.0007. Based on the personnel cost per person this cost is:

$$\text{Personnel Cost } (64,810.00) \times 0.0007 = \$45.37$$

The insurance factor would raise the cost per member of the staff approximately \$46.00.

2. Base level support - The cost of living at Wright-Patterson AFB was not included within the report. This would also allow us to view a support vs non supported function; such as a contractor who was housed in a base facility at no cost. For this effort we will view the support in three different areas: base infrastructure support (roads, water, sewer, trash etc.), real property maintenance, and facilities.

A. Base infrastructure is determined from Table 1-1 of AFR 26-1 Volume II. This provides a value of 11.4% of the personnel cost. Based on the personnel cost per person this cost is:

$$\text{Personnel Cost (64,810.00)} \times 0.114 = \$7388.34$$

B. Real Property Maintenance is determined from Table 1-1 AFR 26-1 Volume II. This provides a value of .9 % of the personnel cost. Based on the personnel cost per person this cost is:

$$\text{Personnel Cost (64,810.00)} \times 0.009 = \$583.29$$

C. Facilities at Wright-Patterson AFB are very extensive and represent a very large investment by the Air Force. If we were just to examine the facilities that house the ASD Acquisition Organizations they had an original cost of \$46M, but we must remember some of these facilities are over 50 years old. To replace these facilities in September 1990 would cost approximately \$204M to house a total population of 6,735 people.

If we assume a 30-year life for these facilities and we started with all new facilities we would have the worst case scenario and the cost per person would be as follows:

$$\text{Facilities Replacement Cost / 30 years / People} = \text{Cost/Person}$$

$$204,000,000 / 30 / 6735 = \$1009.65$$

In summary the final cost can be viewed in several formats and these are presented below:

Table 10. Primarily MTS Cost

Raw Cost	\$ 64,810.00
Support Cost	2,927.00
External Support	2,130.00
Internal Support	6,592.00
Insurance	46.00
Base Infrastructure	7,388.00
RPM	583.00
Facilities	1,010.00
Total	\$ 85,486.00

Is this value accurate? Based on the organizations current personnel count, the answer is yes. Would it be accurate in the future or would it have been accurate based on past values? That becomes an interesting question. Over the past 3 years ASD has been in a period of personnel reductions, hiring freezes to the point where they have lost a considerable number of support personnel; further, a number of management personnel are not managing but rather filling gaps in working on programs. While this may be viewed by some as good, as a means of reducing overhead, it can also be viewed as bad for the long term health of the organization. Over the years the engineering community has had the worst ratio of engineers to clerical in comparison to the rest of the organization. In fact in the past 2 years the number of clerical personnel has decreased by 50%. It is not uncommon to have one secretary to 25-30 engineers or more. I would conclude that the \$85,486.00 value is artificially low. To have a more accurate value under a more normalized work force ratio both the internal and external support values could be doubled. This would, in effect, change the personnel values to the methods of operation prior to the current reductions. This would result in an overall value as shown below. Under normal circumstances the doubling of external and internal support would not be needed.

MTS = ((Salary + Benefits) + 2(External Support + Internal Support)) (1 + Liability Rate + Base Infrastructure Rate + Real Property Maintenance Rate) + Support Cost + Facilities + (Casualty Rate x Equipment / Supply Value)

If we view the salary and benefits average of \$64,810.00 this formula would result in a cost as follows:

$$((64,810) + 2(2130 + 6592)) (1 + 0.0007 + 0.009 + 0.114) + 2927 + 1010 + (0.0005 \times 1222) = \$96,366$$

Table 11 is a listing of the various grades and the cost of that grade for the engineering staff. It was assumed in the development of this table that the work force was at the normalized level¹.

**Table 11. Normalized Cost for an ASD MTS
Fully Loaded Manpower Costs 1992**

Military Rank	Cost(\$)	Civilian Engineer	Cost(\$)
O-6	144,916.00	SES (ES-4)	161,440.00
		GM-15	126,112.00
		GS-15	126,342.00
O-5	126,000.00	GM-14	110,036.00
		GS-14	112,005.00
O-4	110,303.00	GM-13	96,286.00
		GS-13	97,988.00
O-3	94,891.00	GS-12	88,078.00
O-2	79,136.00	GS-11	77,553.00
		GS-09	75,232.00
O-1	65,467.00	GS-07	66,269.00
		GS-05	58,463.00

6. ASD - SSD - ESD

MTS Relationships

In an Air Force Audit conducted in August 1991, the Air Force determined the cost for an MTS from Mitre Corporation and Aerospace Corporation to support Electronic Systems Division and Space Systems Division. The result of that audit is listed below. In another study completed in November 1990, the cost values for both Mitre and Aerospace were also computed and those are also listed below. These costs are shown in comparison to the current ASD costs and the higher value cost. Even at the higher value the cost per ASD engineer is significantly lower. The methods to determine the Mitre and Aerospace values appear to be very similar to those used in this study to formulate the ASD values. The ASD values appear in a range from restricted manning levels to a more normalized level as previously discussed.

ASD	Mitre Corp.	Aerospace	TRW	
\$85,486.00				May 92
\$96,366.00				May 92
	\$151,200.00	\$184,169.00		Aug 91
	\$144,986.00	\$157,139.00	\$161,692.00	Nov 90

As the Air Force limits the growth or forces a reduction of the contracted work force at Aerospace and Mitre, the MTS cost from these contractors will increase at an even faster rate. The fixed overhead burden will remain the same as the number of engineers decrease. This will result in an overall cost increase per MTS. The same would be true at ASD, except ASD is in the process of reducing the number of organizational blocks in engineering to reduce overhead. Over the years the reductions of manning at ASD has resulted in a steady reduction of overhead.

Another factor that can be viewed is the addition of a home office or laboratory support, not directly supporting program offices, but rather building the technology base line. If we even assume a 20% support level the ASD value would increase from \$96,366.00 to \$115,639.00.

Another comparison is that of the SETA contracts. This is more difficult as SETA efforts relate to a specific project and in many cases may be dependent on the level of work effort required. No direct relationship can be drawn in most cases. The one exception may be the relationship with TRW and the Space Systems Division. In this case TRW to a large degree is performing in the same manner as ASD, Mitre and Aerospace. In the November 1990 study, TRW costs per MTS was \$161,692.00.

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